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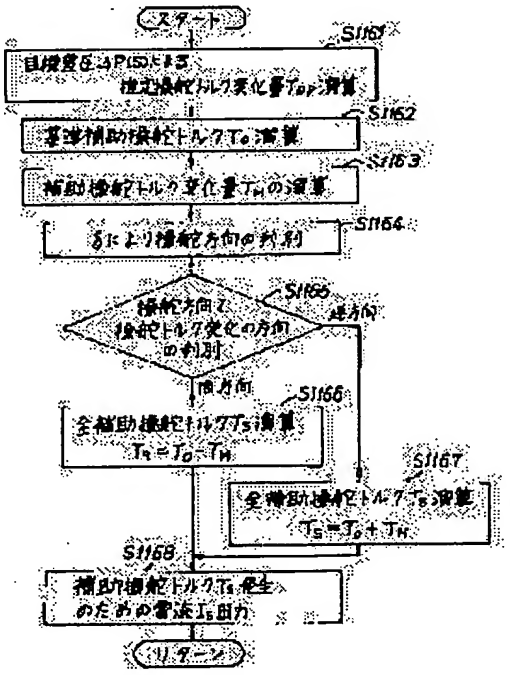
(54) BRAKE POWER CONTROLLER

(57)Abstract:
PURPOSE: To avoid the deterioration of the steering feeling by preventing the variation of the steering power in the brake power control through the genera tion of the lateral brake power difference.
CONSTITUTION: When auxiliary steering power control is carried out for suppressing the variation of the steering power generated by brake power difference for a steering wheel, the auxiliry steering torque variation quantity TH for suppressing the variation of the steering torque which is generated by the differential pressure on the basis of the aimed differential pressure in the brake power difference control or the auxiliary steering torque To as a standard in the ordinary power steering is obtained by a controller (S1161-1163). Further, the controller judges from the differential pressure, if the steering power reduces or increases (S1164-1165), and in case of the reduction direction, the auxiliary steering torque TS is reduced through the subtraction from the standard value TO, and the auxiliary steering power quantity (assistance quantity) is reduced (S1166, 1168). While, in case of the increase direction, addition calculation is performed So that the assisting steering power quantity is increased (S1167, 1168). Accordingly, the variation of the steering power can be reduced.



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* NOTICES *

CLAIMS

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(57) [Claim(s)]
[Claim 1] It has independently controllable braking fluid-pressure control means for the braking fluid pressure of the right-and-left steering wheel steered by the steering gear style. The damping force of the right and left which contain a steering wheel according to the output from a revolution state detection means is made to produce a difference. A control-force variation calculation means to compute the variation of the control force generated according to the right-and-left damping force difference which is a control unit in the vehicles which can control a braking fluid pressure so that it may become a target property about vehicles behavior, and contains a steering wheel at the time of the braking fluid-pressure control concerned, Braking force-control equipment which prepares the control-force control means which control a control force to stop the variation of the control force computed with this control-force variation calculation means, and is characterized by the bird clapper.
[Claim 2] Braking force-control equipment according to claim 1 characterized by for the aforementioned steering gear style having a power assistant means, and controlling a control force by this power assistant means.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the braking force-control equipment which can control damping force to make a predetermined damping force difference generate between the right-and-left rings of vehicles especially about braking force-control equipment.
[0002]
[Description of the Prior Art] The control unit controlled as equipment which controls the damping force of vehicles to distinguish between the damping force of a vehicles right-and-left ring is proposed by these people (Japanese-Patent-Application-No. 1-25064 number etc.). . The control which the swinging nature for example, at the time of revolution braking was raised, or used a damping force difference, such as raising stability, is possible for this braking force control system. Actual yaw REITO of vehicles (real yaw REITO) The braking force control of the yaw rate feedback method which distinguishes between a brake fluid pressure on either side, and controls vehicles behavior to make it in agreement with the target yaw rate set up based on a steering angle, the vehicle speed, etc. is the example, and can be contributed to improvement in driving stability.
[0003]
[Problem(s) to be Solved by the Invention] The braking force control of damping force difference generation is what can add such a new function (active brake) to vehicles. It sets to the introduction the place which is what is made to generate a damping force difference for a steering wheel (or this -- containing), and can control vehicles behavior. If its attention is paid to a control force when the right-and-left ring which generates a damping force difference is a steering wheel, this invention person used to find out that a steering control force sometimes changes with the differential pressure of a right-and-left ring.
[0004] If based on the result considered about this point, the braking fluid pressure of the ring of the same side as the steering direction, for example At the time of the control which will be in the state of a larger relation than that of the ring of another side (the fluid-pressure control which hits giving a difference in addition) single-sided reduced pressure control, single-sided boost control, and the increase for both sides -- or [that it is which mode of reduced pressure control] -- not asking -- a control force becomes light (consideration drawing 11 (**) about control-force change generated by the steering direction and the direction of the force generated according to a damping force difference refer to by making left steering into an example) A control force becomes heavy at the time of the control to which the braking fluid pressure of the ring of the steering direction and an opposite side will be in the state of a larger relation than that of the ring of another side (this drawing 11 (**) refer to). It may get worse, if an operator's feeling of steering is influenced and depends the size of a difference etc. how. The purpose of this invention is enabling it to perform the braking force control which generates [make] a necessary damping force difference, following and damping force difference control mitigating the influence which it has on a feeling of steering.
[0005]
[Means for Solving the Problem] According to this invention, following braking force-control equipment is offered. It has independently controllable braking fluid-pressure control means for the braking fluid pressure of the right-and-left steering wheel steered by the steering gear style. The damping force of the right and left which contain a steering wheel according to the output from a revolution state detection means is made to produce a difference. A control-force variation calculation means to compute the variation of the control force generated according to the right-and-left damping force difference which is a control unit in the vehicles which can control a braking fluid pressure so that it may become a target property about vehicles behavior, and contains a steering wheel at the time of the braking fluid-pressure control concerned, It is braking force-control equipment which comes to prepare the control-force control means which control a control force to stop the variation of the control force computed with this control-force variation

calculation means. Moreover, it is braking force-control equipment which a steering gear style has a power assistant means in the above, and controls a control force by this power assistant means.

[0006]

[Function] Although the above-mentioned braking force-control equipment controls a braking fluid pressure to have independently controllable braking fluid-pressure control means for the braking fluid pressure of right and left of a steering wheel, to make the braking pressure of the right and left which contain a steering wheel according to the output from a revolution state detection means produce a difference, and to become a target property about vehicles behavior A difference is produced at the time of this control, i.e., the damping force of the right and left which contain a steering wheel according to the output from a revolution state detection means. At the time of the braking fluid-pressure control concerned which controls a braking fluid pressure to become a target property about vehicles behavior, the control-force variation calculation means computes the variation of the control force generated according to the right-and-left damping force difference containing a steering wheel. The control-force control means control a control force to stop the variation of the control force computed with this control-force variation calculation means.

[0007] thereby, the damping force difference control which can be made being able to avoid aggravation of the bundles in ** and an operator's feeling of steering for change of the control force by braking fluid-pressure difference control, and suppressing this control-force change raises further the efficiency nature of the vehicles behavior control by it, and contributes to making it an effective thing

[0008]

[Example] Hereafter, the example of this invention is explained in detail based on a drawing. Drawing 2 and 3 are the composition of one example of this invention control unit, drawing 2 shows the composition of the braking force-control system, and drawing 3 mainly shows the composition of a steering system. The vehicles to apply shall be independently controllable in the damping force of right and left of a front wheel and/or a rear wheel, and shall control damping force (braking fluid pressure) on either side for an order ring by this example. Moreover, about a steering system, it considers as P/S vehicles with a power-steering (P/S) mechanism.

[0009] As for the inside 1L and 1R of drawing 2 , a right-and-left rear wheel and 3 show a brake pedal, and 4 shows [a right-and-left front wheel, and 2L and 2R] a tandem piston (M/C), respectively. In addition, 3a is a booster as a booster of a brake, and 4a is a reservoir. When each wheels 1L, 1R, 2L, and 2R are equipped with the wheel cylinders 5L, 5R, 6L, and 6R which carry out friction pinching of the brake disc by fluid-pressure supply, and give a brake force for every ring and the fluid pressure from a master cylinder 4 is supplied by these wheel cylinders (W/C), each wheel shall be braked separately.

[0010] Here to explain the brake fluid-pressure (braking fluid pressure) system of a damping device front-wheel brake-system 7F from a master cylinder 4 You make it result in the right-and-left front-wheel wheel cylinders 5L and 5R through Ducts 8F, 9F, and 10F and the fluid-pressure control valves 11F and 12F. rear wheel brake-system 7R from a master cylinder 4 You make it result in the right-and-left rear wheel wheel cylinders 6L and 6R through Ducts 8R, 9R, and 10R and the fluid-pressure control valves 11R and 12R. The fluid-pressure control valves 11F, 12F, 11R, and 12R It is that with which controls separately the brake fluid pressure which goes to the wheel cylinders 5L, 5R, 6L, and 6R of the wheel which corresponds, respectively, and the business of an anti skid and this braking fluid-pressure control is presented. It is in the boost position of illustration at the time of OFF, and a brake fluid pressure shall be turned to former **, and shall be boosted, and it shall become the dwelling position which does not fluctuate a brake fluid pressure at the time of the 1st-step ON, and shall become the reduced pressure position in which a part of brake fluid pressure is missed and reduced to Reservoirs 13F and 13R (reservoir tank) at the time of the 2nd-step ON. Control of these fluid-pressures control valve is current (control valve drive current) I1 -I4 to the solenoid of the valve which corresponds from the controller (control unit) mentioned later. It is carried out. Current I1 -I4 When it is OA, it is the above-mentioned boost position and current I1 -I4. When it is 2A, it is the above-mentioned dwelling position and current I1 -I4. When it is 5A, it shall become the above-mentioned boost position. In addition, the brake fluid in reservoir 13F and 13R is returned to Ducts 8F and 8R with the pumps 14F and 14R driven at the time of the above-mentioned dwelling and reduced pressure, is returned to the accumulators 15F and 15R of these ducts, and reuse is presented with it.

[0011] The fluid-pressure control valves 11F, 12F, 11R, and 12R by the controller 16 The signal from the steering angle sensor 17 which turns on, carries out OFF control and detects the steering angle of a steering wheel (handle) for this controller 16, The signal from the brake switch 18 switch on at the time of trodding of the brake pedal 3, The signal from the wheel speed sensors 19-22 which detect the rotation peripheral speed (wheel speed) VW1-VW4 of Wheels 1L, 1R, 2L, and 2R, the signal from yaw REITO 23 which detects yaw REITO (d/dt) phi generated on vehicles, etc. are inputted, respectively. The signal from a wheel sensor is used also for an antiskid control.

[0012] moreover -- a controller 16 -- fluid-pressure P1 -P4 of the wheel cylinders 5L, 5R, 6L, and 6R of each ring

while the signal from the fluid-pressure sensors 31L, 31R, 32L, and 32R to detect is inputted -- fluid pressure PM of a master cylinder 4 (the front-wheel system fluid pressure PM 1, the rear wheel system fluid pressure PM 2) Fluid-pressure sensor 331,332 to detect from -- a signal is inputted It detects only, for example by the front-wheel system, and you may make it make it represent about master cylinder fluid-pressure detection. As [make / in agreement with the desired value / output / the output of a fluid-pressure sensor sets up the desired value of a wheel-cylinder fluid pressure, and / an actual wheel-cylinder fluid pressure] (the deflection of this setting desired value and an actual wheel-cylinder fluid-pressure value becomes near zero or the zero like) It is used as a control signal in the case of operating a fluid-pressure control valve and controlling a brake fluid pressure.

[0013] The signal from a steering angle sensor is used as the parameter which expresses a vehicles revolution state with itself, or its part. Moreover, the signal from a yaw rate sensor is used as a control parameter in the fluid-pressure control by the yaw rate feedback method. Furthermore, the signal from a wheel speed sensor can be used as information for car-body-speed presumption in the case of using the vehicle speed as a control parameter, and is used also for the antiskid control made by the controller 16 like description.

[0014] In addition, at an antiskid control, by what is depended on 4 like this example, and 4 sensor methods, the wheel speed detection value for every ring, and a car-body-speed detection value and the amount detection value of slips are acquired, a braking force control is performed so that the amount of slips of an applicable wheel may be made into the predetermined range, and thereby, a wheel is made as [attain / the maximum braking efficiency / per each ring / an antiskid control is carried out separately and], and avoids a wheel lock.

[0015] The above-mentioned controller 16 changes including an input detector, a data-processing circuit, the store circuit that stores various control programs, the result of an operation, etc. which are performed in this data-processing circuit, the output circuit which supplies a control signal to a fluid-pressure control valve. When performing control of making the damping force of right and left of vehicles produces [control] a difference in a data-processing circuit at the time of braking namely, in order to control damping force to control vehicles behavior Based on predetermined input, the program for braking force controls by the yaw rate feedback method is followed. A target yaw rate, car body speed, a target wheel-cylinder fluid pressure (target brake fluid pressure), etc. are calculated, the desired value as a brake-force (braking fluid pressure) control value for every ring is acquired, and the signal equivalent to it is outputted to a fluid-pressure control valve. Including a fluid-pressure control valve and a controller, at the time of braking, make the braking fluid pressure on either side as for a front wheel and/or a rear wheel as the control to desired value is independently possible, and the braking fluid pressure of right and left of a controlled-system wheel is made to produce a difference, and a means to control a braking fluid pressure to become a target property about vehicles behavior consists of this examples.

[0016] In case a controller 16 makes a difference generate about the control (active brake control) by the further above-mentioned damping force difference, it performs control which prevents the operating physical force of a steering changing at the time of this control.

[0017] The pinion gear 53 which gears with the rack gear section in the rack 52 of a steering mechanism 51 for an example of the composition of a steering system to be shown in this, and explain a front-wheel steering system in drawing 3 if drawing 3 is seen enables steering of front wheels 1L and 1R through a rack, a side rod, and a steering knuckle arm, when connecting with a steering wheel 55 through a steering shaft 54 and rotating a pinion gear with a steering wheel. In the above-mentioned steering gear which transmits the control force of a steering wheel to a wheel, in order to carry out the power assistance of the front-wheel steering, vehicles are further equipped with power-steering (P/S) equipment. It forms a power cylinder 57 in relation to stearin GUKYA 51 while this equipment shall be based on the mechanism in which a means to operate according to a control force and to generate the assistant force is made to intervene, shall be based on a hydraulic actuation formula as this assistant means here and forms the oil-pressure-control section 56 for power steering in relation to a steering shaft 54.

[0018] Further, the system in this case is equipped with a pump 58 and a reservoir 59, and connects the hydraulic-pressure-supply circuit a of the above-mentioned hydraulic power unit, and the drain circuit b of a hydraulic power unit to the oil-pressure-control section 56, respectively, and connects them with the cylinder rooms 57a and 57b by the interlocking-gyri ways c and d to a power-cylinder side, respectively. These rooms are formed by the piston 60, and this piston fits in free [sliding] in a cylinder body while fixing this on a rack 52. The P/S oil-pressure-control section is taken as the thing of composition of having the P/S solenoid valve 81 mentioned later, while having the control valve 71 which generates the **** assistant oil pressure shown in drawing 4 . In addition, the appearance composition is also shown in the same drawing here in connection with the power steering mechanism (p/S gear) 51 per control valve 71.

[0019] It connects with the supply port of a control valve 71 through the oilway of the hydraulic-pressure-supply circuit a, and the oil pump 58 for rotational frequency induction type power steering of built-in of Rota, a blade, a relief valve, a flow control bulb, etc. makes the return port result to a reservoir tank 59 through the oilway of the drain circuit

b in this drawing. Moreover, two control ports which are a part for the Division for Interlibrary Services to each cylinder rooms 57a and 57b operate the pressure oil from a pump 58 mutually through the connection circuits c and d by these as the regurgitation or a port to inhale according to the steering wheel operation direction and a control input.
[0020] The cylinder piston 60 performs power assistance with the oil pressure controlled by the control valve 71. A pressure differential is not produced in the cylinder room of piston right and left, but a piston maintains neutrality, therefore a front wheel is maintained at the state where it does not steer, at the time of rectilinear propagation, and it may make vehicles go straight on in the neutral state. On the other hand, when steering a front wheel through a gear with a steering wheel, the power assistance of the steering is carried out by power steering, and light power steering is made to perform. For this reason, when a control force is applied by steering wheel operation, according to this, the pressure and direction of the oil sent from POMBU are controlled, it sends to the left or right-hand side of a piston 60 alternatively, the power assistance of the piston is carried out in the corresponding direction by this, and a control valve 71 is ******** or ** about a front wheel. in this case -- while an operator senses road surface reaction force also including the oil pressure reaction force by the below-mentioned oil pressure reaction force method -- the left -- or right steering can be carried out
[0021] If it is at the time of left steering, at the time of the left end, oil pressure acts on the loculus 57a side of a piston 60 by the operation of a control valve 71, and carries out the power assistance of the piston. That is, addition of a control force is made to the piston 60 which acts from one control port to the loculus 57a side, and moves through a gear 51, and the hydraulic oil from a high-tension-side oilway serves as the force of making it moving in the direction which carries out a rack 52 and carries out left steering of the front wheel. At this time, the oil extruded by the piston 60 from the loculus 57b side returns through the control port of another side, and returns from a port to a reservoir tank.
[0022] In this way, according to the control input of **** and a steering wheel, a pressure is generated in left steering, now, the power assistance of the left steering of a front wheel is carried out, and power steering is enabled with the necessary amount of assistance (the amount of auxiliary control forces). The power assistance of the right steering will be carried out by the oil pressure which also generates the case at the time of the right end according to the operating physical force of a steering wheel according to the above.
[0023] The oil pressure reaction force rooms 72 and 73 in which an oil pressure control is possible in the control-valve mechanism like illustration are established in the control valve 71 of the above power steering, and proper road surface reaction force is told to an operator with reaction force spring action or the oil pressure reaction force to cut. While preparing the branch circuit which has drawing 90 in the middle of the high-tension-side oilway which results from a pump 58 to a control-valve supply port and making the oilway 91 of this drawing lower stream of a river reach each oil pressure reaction force rooms 72 and 73 for the oil pressure control of this oil pressure reaction force interior of a room, it connects with the P/S solenoid valve 81, and this bulb connects the drain circuit b to the through reservoir tank 59. so that the P/S solenoid valve 81 can be considered as the composition which controls the oil pressure of an oilway 91 for example, by duty control as a thing according to the duty ratio, for example, oil pressure of an oilway 91 is made into a high-tension-side oilway (supply hydraulic circuit a) and this ** at 0% of duty ratios and a TEYUTI ratio takes a size value -- the oil pressure of an oilway 91 therefore the reaction force room 72, and 73 internal pressure -- smallness -- adjustment control shall be carried out at a value
[0024] Control of the above-mentioned P/S solenoid valve 81 performs this by the aforementioned controller 16, and is the control current information separator from a controller 16. The solenoid of this bulb is driven and the size of oil pressure reaction force is controlled. That the aforementioned damping force difference control and timing should be doubled, and the amount of assistance should be controlled by the data-processing circuit of a controller 16 The program for control-force control (auxiliary control-force control sub routine program performed in the step which corresponds in the example of after-mentioned drawing 6) is followed. It is a control signal information separator so that the amount of target auxiliary control forces etc. may be calculated and change of the control force generated according to a braking fluid-pressure difference may be lessened. A controller 16 is outputted to the P/S solenoid valve 81 through the output circuit of opposite Perilla frutescens (L.) Britton var. crispa (Thunb.) Decne.
[0025] What is shown in drawing 5 expresses as a block an example of drawing 2 for these the control of both, and the outline of the function in the example system shown in 3. Vehicles have power-steering system 40h, and a control unit contains auxiliary control-force control-means 40c besides independently controllable braking fluid-pressure control-means 40a and revolution state detection means 40b for the braking fluid pressure of right and left of a steering wheel (drawing 5 front wheels 1L and 1R).
[0026] According to the output from revolution state detection means 40b, braking fluid-pressure control-means 40a makes the braking fluid pressure of right and left of front wheels 1L and 1R produce a difference, and controls an auxiliary control force here to suppress change of the control force in which nothing and auxiliary control-force

control-means 40c generate control of a braking fluid pressure according to the braking fluid-pressure difference of a front wheel at the time of braking fluid-pressure control so that it may become a target property about vehicles behavior.

[0027] The above-mentioned braking fluid-pressure control-means 40a is constituted including the controller 16 and the fluid-pressure control valves 11F and 12F of drawing 2 . The above-mentioned auxiliary control-force control-means 40c shall be constituted including a controller 16 and the P/S solenoid valve 81. The content of the oak which is the thing of drawing 4 in which it is an P/S vehicle, for example, a power-steering system contains the above-mentioned P/S solenoid valve here, and control-force control When the ring to which a fluid pressure becomes large by the steering wheel of the steering direction and braking fluid-pressure control is the same Since a control force becomes light, make small the amount of auxiliary steering by auxiliary control-force control means (the amount of assistance), and when the steering wheel of the steering direction and the ring to which a fluid pressure becomes large by braking fluid-pressure control are reverse, conversely Since a control force becomes heavy, it controls the auxiliary steersman stage to suppress change of nothing and a control force so that the amount of auxiliary control forces by auxiliary control-force control (the amount of assistance) may be enlarged.

[0028] Let the oak and power steering which can control an auxiliary control force to suppress change of the control force generated according to a braking fluid-pressure difference be the thing of an electric formula. Moreover, a revolution state detection means is constituted including some of corresponding sensors and controllers.

[0029] Drawing 6 is an example of the control program for the vehicles behavior control by the braking fluid-pressure difference to which the aforementioned auxiliary control-force control performed by the controller 16 was made to relate. This processing is execution ****** by regular interruption for every fixed time with the operating system which is not illustrated.

[0030] drawing -- setting -- first -- Step S110 -- a basis [output / of a steering angle sensor, a wheel speed sensor, a yaw rate sensor, a wheel cylinder, and a master cylinder fluid-pressure sensor] -- the steering angle delta, the wheel speed VW1-VW4 of each wheels 1L, 1R, 2L, and 2R, yaw REITO(d/dt) phi, and master cylinder fluid pressure PM And wheel-cylinder fluid-pressure P1 -P4 of each ring It reads, respectively. The speed of the body is presumed at continuing Step S111. In this example, it asks for car body speed (false vehicle speed) by the operation by the technique usually performed by the antiskid control using the wheel speed (wheel rotational frequency) of all wheels, and let this be the vehicle speed value V.

[0031] Next, it is target yaw REITO (d/dt) phiref from the above-mentioned vehicle speed V and the steering angle delta at Step S112 here because of the yaw rate feedback braking force control at the time of braking (active brake). It calculates. Suppose that it asks according to the following formula by this operation agent about calculation of target yaw REITO.

[Equation 1]

(d/dt) phiref = deltaxV/A (1+KV2) --- (1) -- it is the constant as which A is a constant decided by the wheel base and steering gear ratio of vehicles, and K expresses the steer property of vehicles here target yaw REITO (d/dt) phiref calculated at the above-mentioned step S112 in the following step S113 yaw REITO which is a difference with actual yaw REITO (d/dt) (real yaw REITO) phi -- difference -- value delta(d/dt) phi -- the following formula and [Equation 2]

delta(d/dt) phi=(d/dt) phiref-(d/dt) phi --- It computes by (2) and target differential pressure deltaP (S) which should generate the wheel cylinder of right and left of a controlled-system wheel is calculated based on ** delta(d/dt) phi at continuing Step S114 according to the following formula.

[Equation 3]

deltaP(S) = Hxdelta (d/dt) phi --- (3) -- it is the constant to which H becomes settled by the vehicles item here

[0032] Including the size and polarity, deltaP (S) value calculated by the one to 3 above-mentioned formula can embrace the revolution direction, the state at the time of revolution, etc., and can be determined and computed. in addition, the case where it is based on the three above-mentioned formula -- a yaw rate -- difference, as the feedback control method for value delta(d/dt) phi, although the so-called proportional control method will be used, it is good also as the control method which added not only this but both derivative control action and integral control action [both / either or] If it does in this way, the real yaw REITO responsibility and stability of vehicles over target yaw REITO can be improved.

[0033] At Step S115 which carries out a deer and continues, they are above-mentioned target differential pressure deltaP (S) and the master cylinder fluid pressure PM. Target wheel-cylinder fluid pressure Pj (S) and (j=1-4) are calculated. It supposes that it gives by the front wheel side about the difference of the braking fluid pressure between the right-and-left rings for controlling vehicles behavior by this example to become a target property, and desired value is computed according to the following formula.

** In the case of deltaP(S) >=0, it is [several 4].
P1 (S) =PM-deltaP (S) --- (4) P2 (S) =PM --- (5) P3 (S) =PM --- (6) P4 (S) =PM --- In the case of (7) **deltaP(S) <0, it is [several 5].
P1 (S) =PM --- (8) P2 (S) =PM-deltaP (S) --- (9) P3 (S) =PM --- (10) P4 (S) =PM --- (11) [0034] At this example, they are a hard composition top and wheel-cylinder ** PJ. Master cylinder ** PM Since it was not able to raise above, although it became the above desired value, one side can be boosted for the differential pressure between right-and-left rings, and it can be made to generate by making one side decompress by adding a boost function.
[0035] Next, at this example program, when braking fluid-pressure control is performed according to desired value delta[of the differential pressure calculated above] P (S) so that it may distinguish between front-wheel right and left now, processing for controlling the amount of auxiliary control forces about change of the control force generated by the differential pressure deltaP (real differential pressure) to stop this is performed at Step S116. It makes the content processing for adjusting so that assistance of power steering may be lessened or may be made [many] according to differential pressure, and drawing 7 shows an example of the starting auxiliary control-force control routine. Variation of the steering torque generated at Step S1161 in the sub routine of this drawing when differential pressure deltaP is attached to the braking fluid pressure of a right-and-left ring according to a target; the presumed steering torque variation TDP is calculated. In this example, this is calculated based on a calculation target differential pressure deltaP. (S) value according to the following formula.
[Equation 6]
TDP=K1 xdeltaP (S) --- (12) It is K1 here. It is the constant which becomes settled according to a vehicles item and a steering mechanism. In addition, K1 Not only this but the steering angle delta, and lateral acceleration Yg It is good also as a function.
[0036] Next, at Step S1162, it is the criteria auxiliary steering torque TO. It calculates. this criteria auxiliary steering torque TO Case where are the thing of the steering torque controlled by the usual power stay ring, and a braking fluid-pressure difference is not controlled (in namely, the case of deltaP(S) =0) **** -- steering torque TS set up in the following processing not more than step S1163 a value -- TS =TO becoming -- a result -- usual -- it becomes power steering This criteria auxiliary steering torque TO It is the criteria torque TB which becomes settled in this example about an operation according to the steering angle delta as shows an example of each property to drawing 8 and 9. A value and steering torque coefficient mv which becomes settled by the vehicle speed V It shall ask and shall compute as follows than these.
[Equation 7] TO =mv xTB --- (13) [0037] Auxiliary steering torque variation TH for suppressing change of the steering torque generated by differential pressure deltaP at continuing Step S1163 The following formula [several 8] TH =TDP --- it sets up by (14), and further, at Step S1164, the steering direction is distinguished by change of the steering angle delta, and the steering direction distinguished at the above-mentioned step S1164 in Step S1165 and the direction of steering torque change generated by differential pressure deltaP carry out distinction about whether it is this direction or it is an opposite direction
[0038] It is TS in Step S1166 which touched previously to make [a deer is carried out, and] auxiliary steering torque into smallness as a result of the above-mentioned distinction, when judged with this direction. It is TS in Step S1167 to make auxiliary steering torque into size, when it progresses to value data processing and is judged with an opposite direction. It progresses to value data processing. Moreover, in here, by this example, in being in a **** state, suppose that the processing (Step S1167 side) to the direction which enlarges auxiliary steering torque is chosen (that is, suppose that it judges with an opposite direction and processing is advanced).
[0039] If differential pressure is made to generate so that it may be set to aforementioned target differential pressure deltaP (S) when it is distinguished from this direction at the above-mentioned step S1165 and progresses to Step S1166, it will be the direction where a control force becomes light by the differential pressure deltaP. If it says by the case of drawing 11 , the force of the direction of a white arrow generated according to this damping force difference to left steering of the steering wheel by the oak and operator who produce a right-and-left damping force difference like this drawing (b) in the left end will be the same direction, and a control force will be a time of becoming light. for this reason -- this step S1166 -- this case -- all auxiliary steering torque TS According to the following formula, it computes and only the part sets this up so that only the part to which a control force becomes light by differential pressure deltaP (=deltaP (S)) and which will come out and exist namely, -- may become small.
[0040]
[Equation 9]
TS =TO-TH --- (15) above is reference values TO. Auxiliary steering torque variation TH of a shell By deducting, it corrects in the direction which lessens the amount of assistance by power steering, and means suppressing change in the direction which becomes light [an above-mentioned control force]. since it is the direction where a control force

becomes heavy by differential pressure deltaP on the other hand when it is distinguished from an opposite direction at Step S1165 and progresses to Step S1167 -- this step S1167 -- all auxiliary steering torque TS only as for the part, only the part to which a control force becomes heavy by differential pressure deltaP and which will come out and exist namely, -- becomes large -- as -- value TS It computes and sets up according to the following formula.
[Equation 10]
TS =TO+TH --- (16) [0041] The force of the direction of a white arrow which similarly will be generated according to the oak which produces a damping force difference in a relation like this drawing (b), and its damping force difference at this time if drawing 11 is taken for an example is an opposite direction to the steering direction. The part control force is a reference value TO at a bird clapper to the 16 above-mentioned formula heavily. It receives and is TH. It corrects in the direction which decides to add and makes the amount of assistance size, and suppose that change in the direction which becomes heavy [an above-mentioned control force] is suppressed. In this way, it is TS to lessen control-force change in any case. A value is calculated and set up. In this way, they are all the auxiliary steering torque TS. If it sets up, suppose that output processing is performed in SUPPU S1168 in this example program. Namely, TS calculated at Step S1168 by either the above-mentioned step S1166 or Step S1167 It responds to a value and they are all the auxiliary steering torque TS. Current value information separator which should be outputted to the P/S solenoid valve 81 since it generates It sets up and outputs by this routine. In addition, the control current information separator It is drive current [as opposed to / in / the wrapup of the program of drawing 6 / output processing] a fluid-pressure control valve / Ij. It is easy to be natural even if it carries out to compensate for output processing.
[0042] It returns to drawing 6 , after processing execution are Steps S117 and S118 at Step S116, and it is the target wheel-cylinder fluid-pressure value Pj. Since it may happen when (S) becomes a negative value, it is the target wheel-cylinder fluid pressure Pj in that case. Processing for making (S) into a value 0 is performed. After carrying out a deer and defining the target wheel-cylinder fluid pressure of each wheel like ****, in Step S120, brake fluid-pressure control is performed so that it may actually become a target fluid pressure about the wheel-cylinder fluid pressure (brake fluid pressure) of each ring, respectively, and this program is ended. Drawing 10 shows an example of this brake fluid oppression routine. This sub routine determines a boost of each wheel-cylinder fluid pressure, dwelling, and reduced pressure, follows the determination, and is drive current I1 required for the fluid-pressure control valves 11F, 12F, 11R, and 11R, I2, I3, and I4. It consists of the processing to output.
[0043] That is, it sets to this drawing and is the target wheel-cylinder fluid pressure Pj at Step S121. (S) is compared with the actual wheel-cylinder fluid pressure Pj (they are P1 [of read in] - P4 value at Step S110 of drawing 4 (j=1-4)), and it is absolute value |Pj of the difference. (S)-Pj | confirms whether to be below predetermined value deltaalpha set up beforehand. When the above-mentioned absolute value is below value deltaalpha as a result of this distinction (when an answer is Yes) Actual wheel-cylinder fluid pressure Pj It is the target wheel-cylinder fluid pressure Pj mostly. It concludes that it is in the state where it is controlled by (S), and progresses to dwelling processing of Step S122 then, and a fluid-pressure control valve is controlled to hold this fluid-pressure state.
[0044] When an absolute value is larger than value deltaalpha on the other hand as a result of the above-mentioned distinction (when an answer is No) It is the target wheel-cylinder fluid pressure Pj at Step S123 further. (S) and actual wheel-cylinder fluid pressure Pj Size is compared and it is the target wheel-cylinder fluid pressure Pj. When the (S) is larger, it progresses to boost processing of Step S124, and a fluid-pressure control valve is controlled to boost a wheel-cylinder fluid pressure. On the contrary, actual wheel-cylinder fluid pressure Pj When the direction is large, it progresses to reduced pressure processing of Step S125, and a fluid-pressure control valve is controlled to decompress a wheel-cylinder fluid pressure.
[0045] In this way, the current value which shall determine the dwelling of a wheel-cylinder fluid pressure, a boost, and reduced pressure, and should be outputted to a fluid-pressure control valve according to this determination is set up, and it outputs by this routine. By execution of the above control, even when the right-and-left ring which generates a damping force difference in control of the vehicles behavior by the right-and-left damping force difference is a steering wheel, aggravation of an operator's feeling of steering can be avoided by lessening change of the control force by the braking fluid-pressure control. While controlling vehicles behavior by this example in the yaw rate feedback control at the time of braking by preparing differential pressure in the braking fluid pressure of a pre-right-and-left ring, the control-force change at the time of braking fluid-pressure control can be appropriately suppressed by presuming beforehand change of the control force produced by differential pressure deltaP which makes it generate in the steering wheel concerned, and controlling auxiliary steering torque.
[0046] In addition, although ********** is a yaw rate feedback braking force control, this invention can also carry out control using yaw rate feedback control. Moreover, it is not limited to what is depended on the above-mentioned composition about control-force change suppression. For example, although the type of power steering used the reaction force control type in the example, it may use the control-of-flow type which controls the flow rate of the

hydraulic oil supplied to a control valve, and the pressure-control type which controls an output pressure by making adjustable the orifice opening property of the control valve itself. In what has a usual power-steering system and a usual auxiliary actuator, you may be made to carry out by controlling an auxiliary actuator. Moreover, above, although it was a steering gear style with power steering While establishing the friction object which non-P/S vehicles can also be carried out, for example, can generate frictional force between shafts in contact with the peripheral surface of a steering shaft By what (for example, also in drawing 7 , it adjusts according to the same procedure) a press means to press this friction object is established, and the press force is adjusted for Even if it is made to control a control force like, the thing which suppress change of the control force generated according to a damping force difference (the oak frictional force to which a control force becomes light decreases an increase and the oak frictional force which becomes heavy) and for which control-force change is mitigated similarly is possible. It is large, and the scope of this invention is practical and is effective also at this point. this invention is applicable also to 4WS vehicles again.
[0047]
[Effect of the Invention] According to this invention, according to this, change of a control force can be suppressed at the time of damping force difference control, and the braking force control which can avoid that an operator's feeling of steering gets worse can be realized.

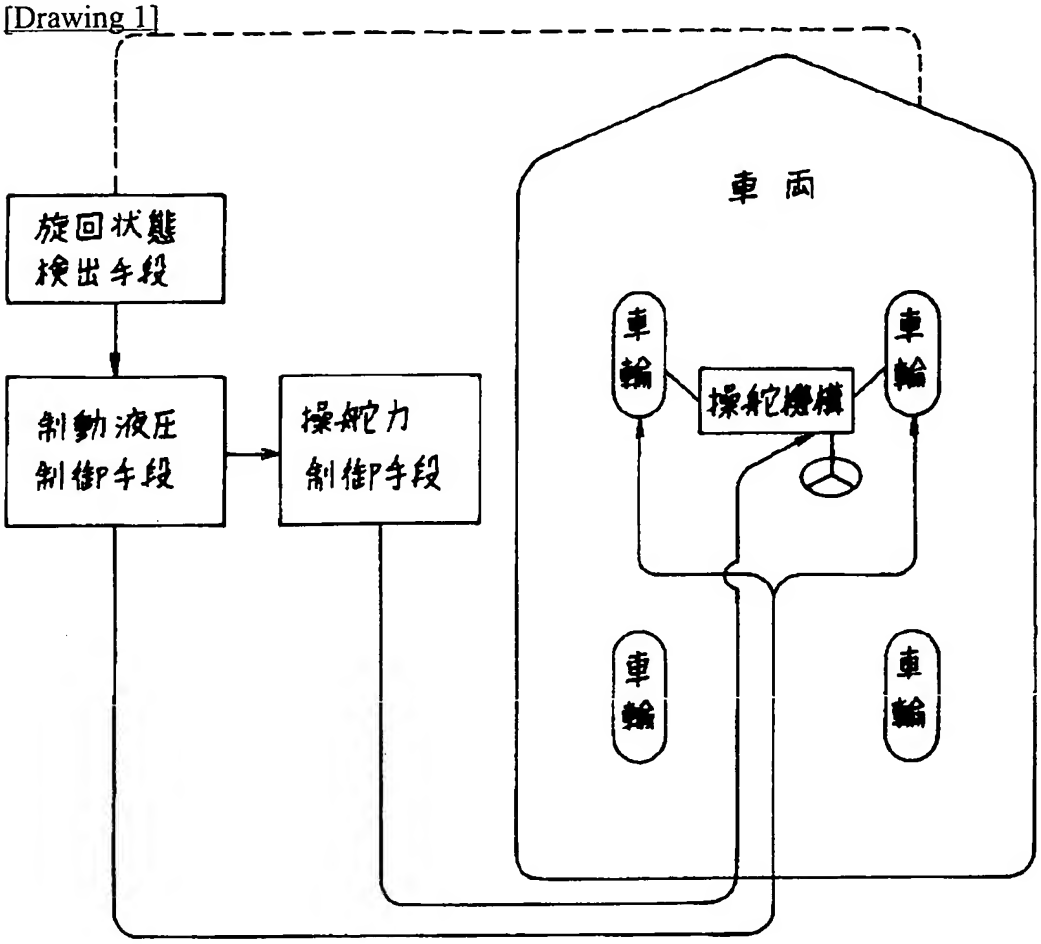
[Translation done.]

* NOTICES *

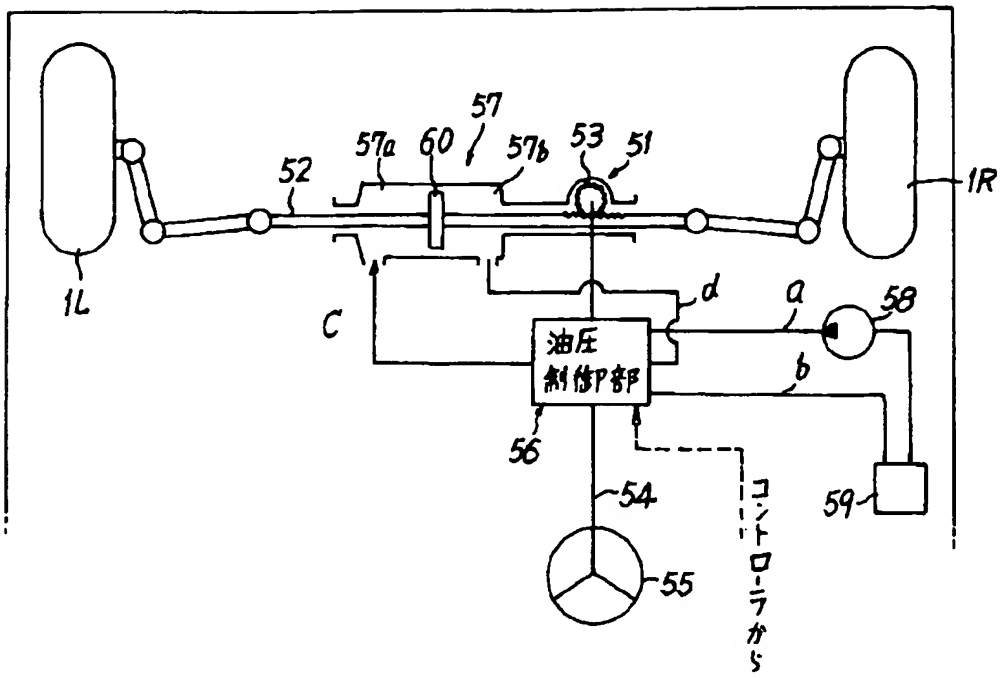
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]

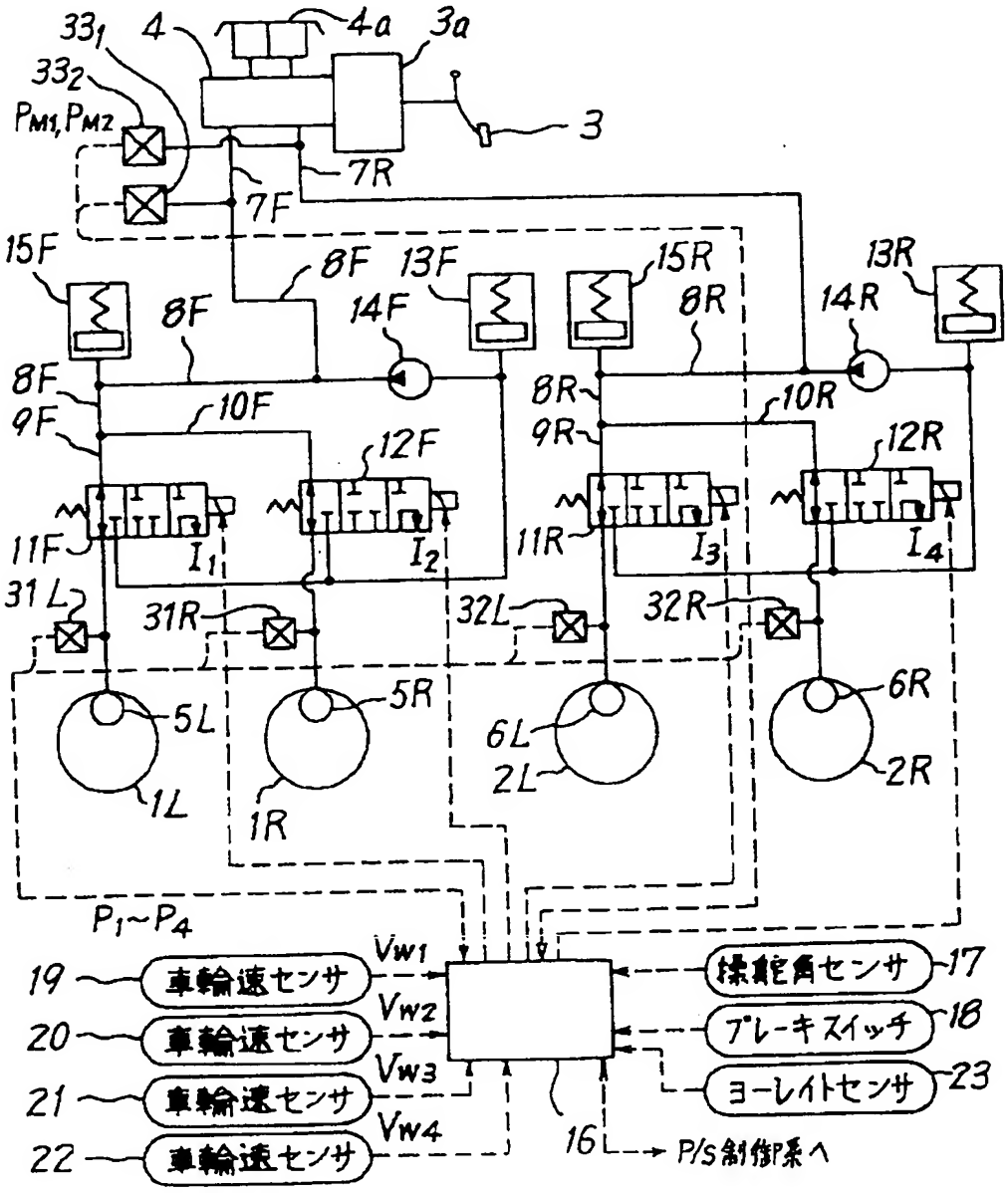


[Drawing 3]

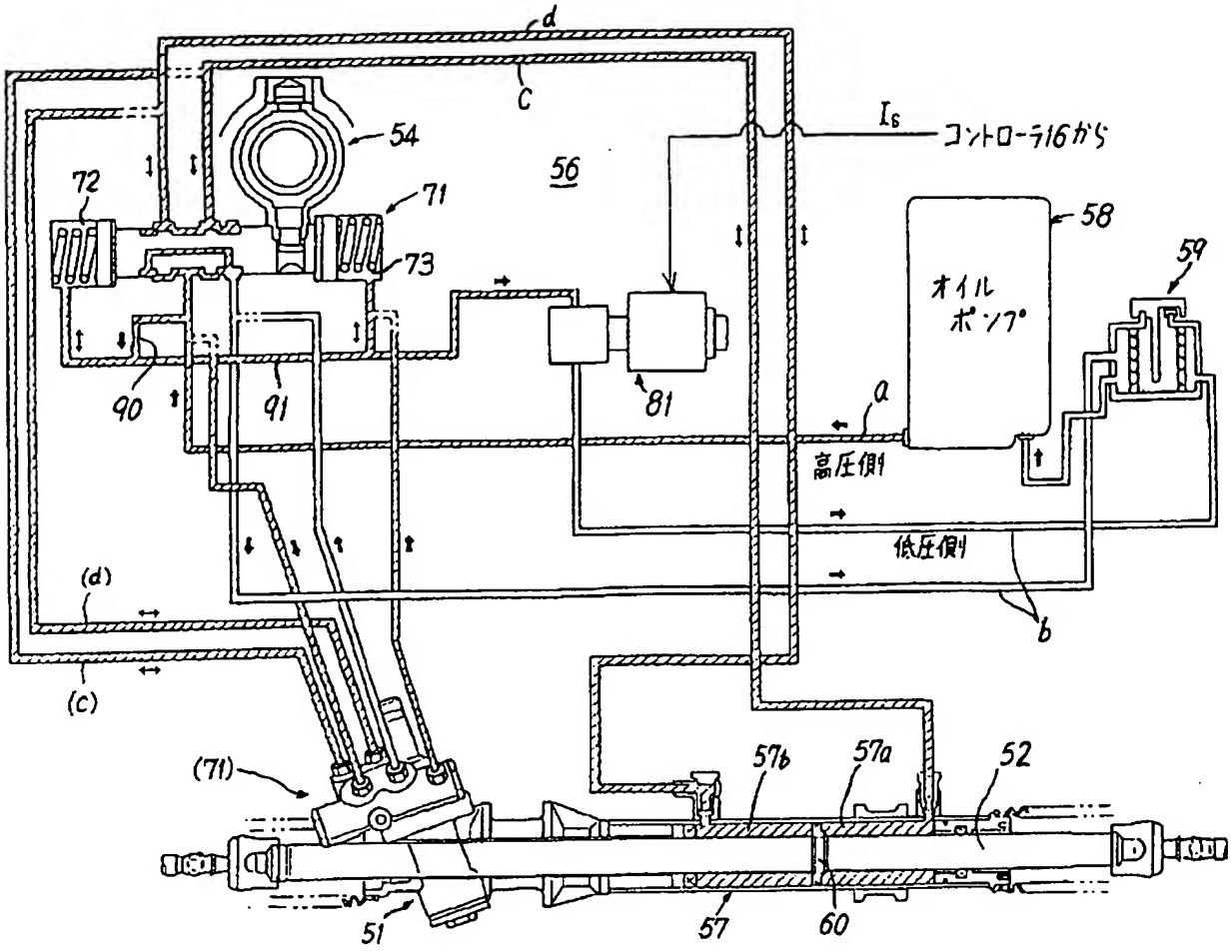


[Drawing 2]

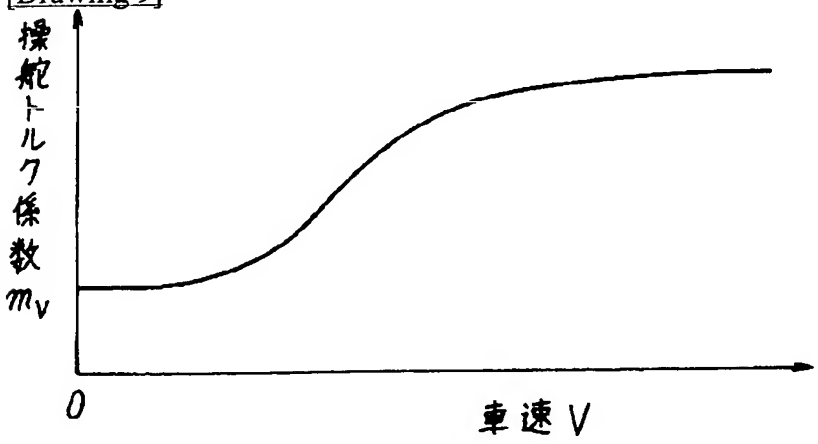
1L, 1R：左右前輪　　2L, 2R：左右後輪
5L, 5R, 6L, 6R：ホイールシリンダ　11F, 12F, 11R, 12R：液圧制御弁
16：コントローラ（制動力液圧制御手段，操舵力制御手段）



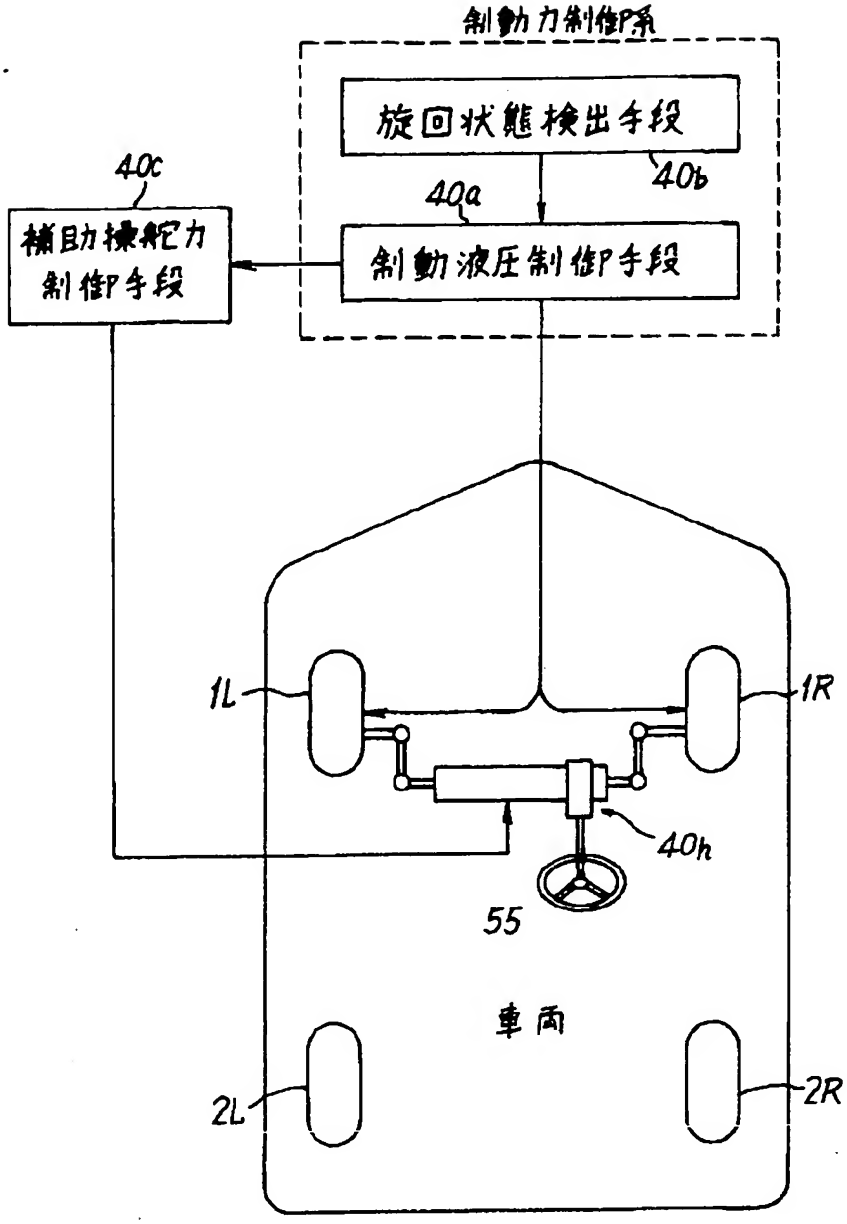
[Drawing 4]



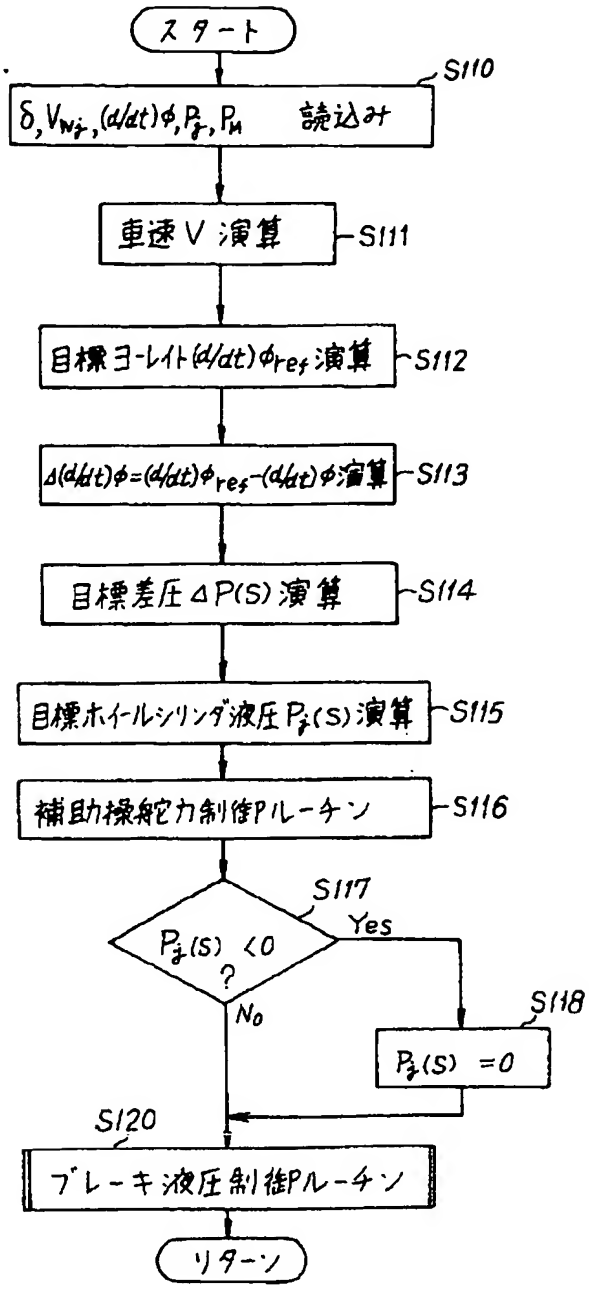
[Drawing 9]



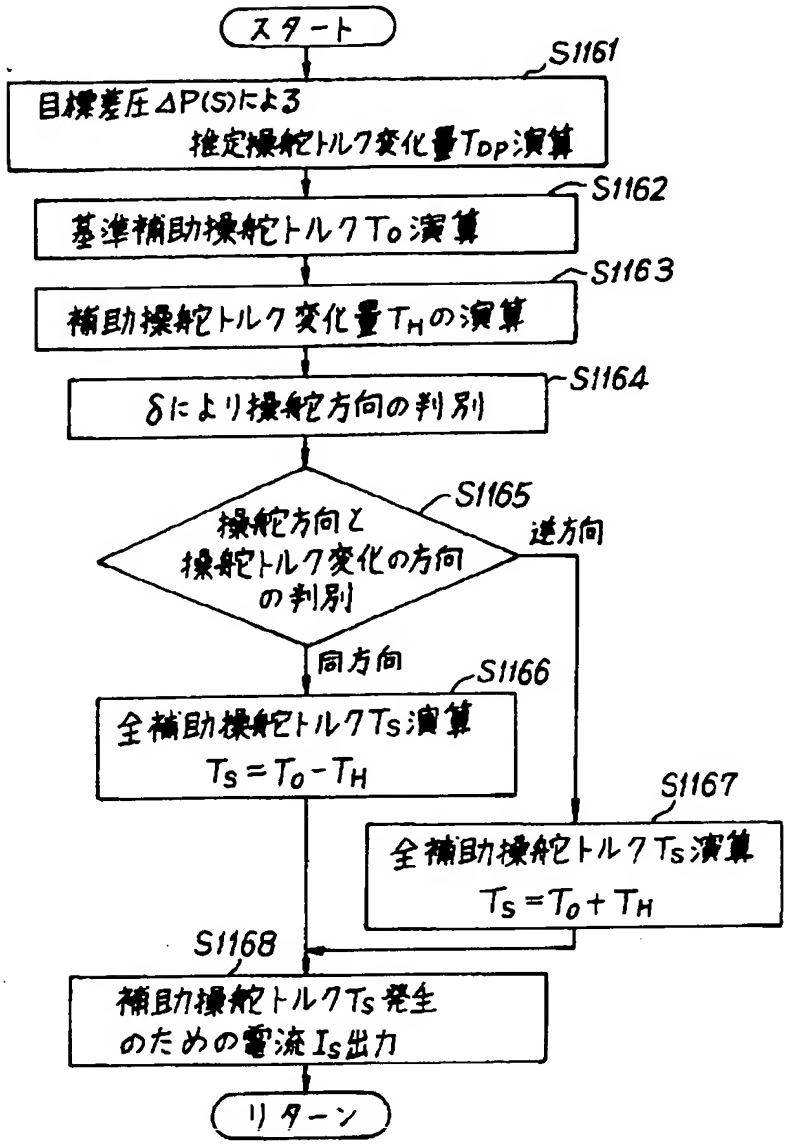
[Drawing 5]


制動力制御系
旋回状態検出手段
40b
40a
40c
補助操舵力制御手段
制動液圧制御手段
1L
1R
40h
55
車両
2L
2R

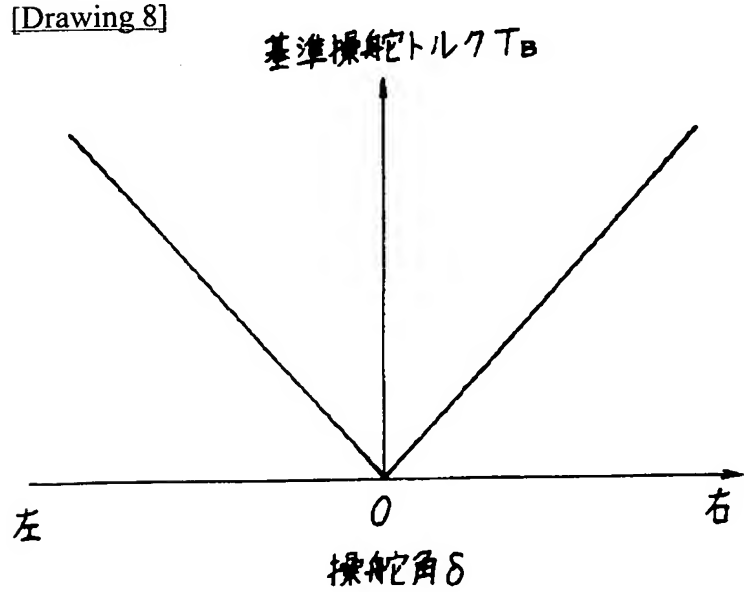
[Drawing 6]


スタート
S110
δ, Vwi, (d/dt)φ, Pf, PM 読込み
車速V演算
S111
目標ヨーレイト(d/dt)φref演算
S112
Δ(d/dt)φ=(d/dt)φref-(d/dt)φ演算
S113
目標差圧ΔP(S)演算
S114
目標ホイールシリンダ液圧Pf(S)演算
S115
補助操舵力制御Pルーチン
S116
S117
Pf(S) <0 ?
Yes
No
S118
Pf(S) =0
S120
ブレーキ液圧制御Pルーチン
リターン

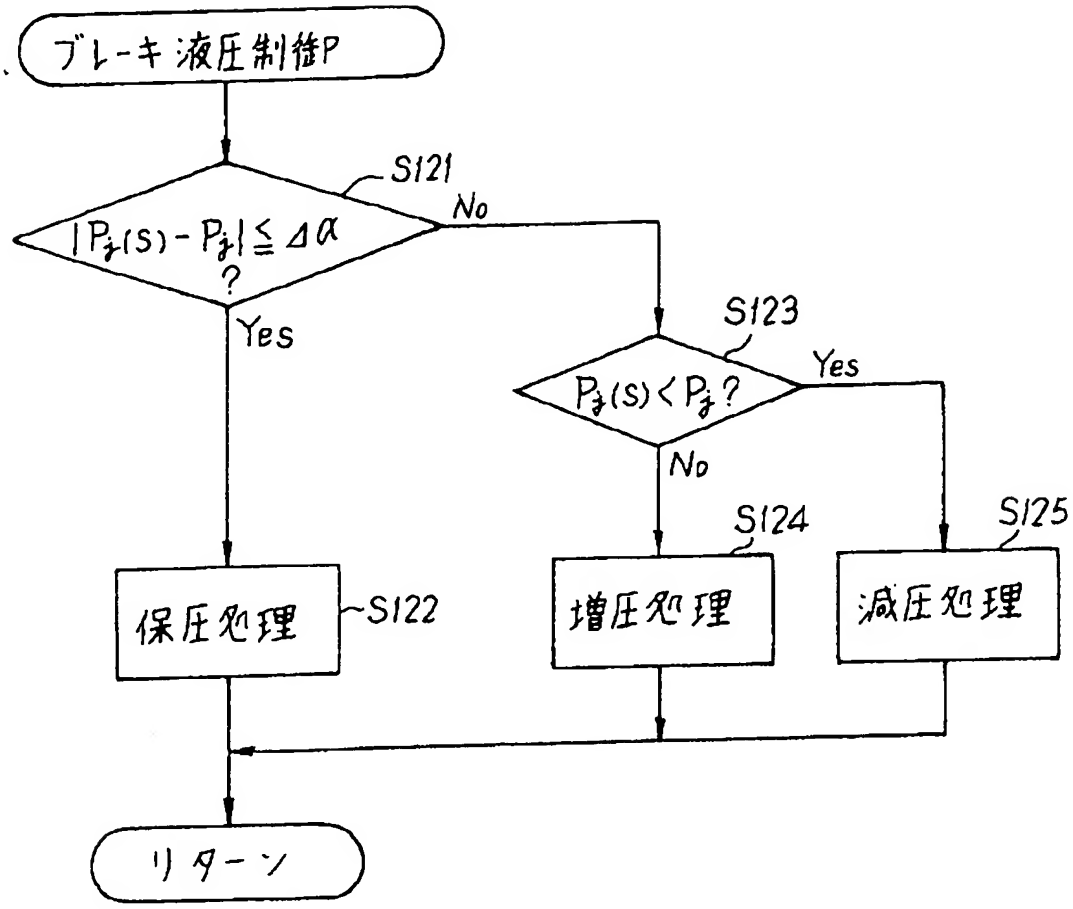
[Drawing 7]



[Drawing 8]

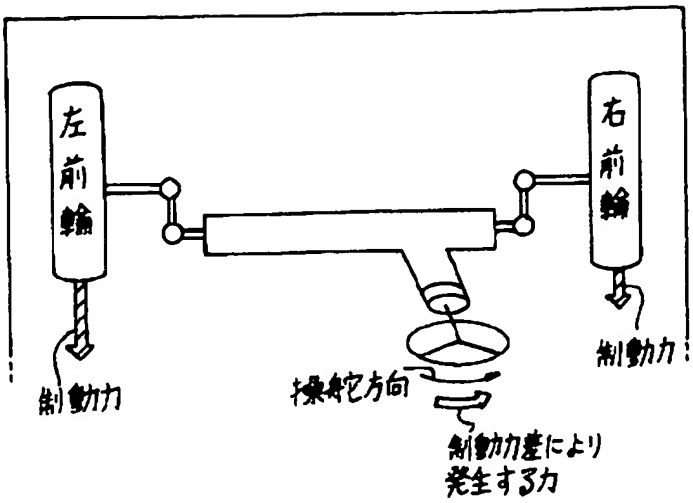


[Drawing 10]


ブレーキ液圧制御P
S121
No
$|P_s(S) - P_s| \leqq \Delta\alpha$?
Yes
S123
$P_s(S) < P_s$?
Yes
No
S124
S125
保圧処理
S122
増圧処理
減圧処理
リターン

[Drawing 11]

(イ)



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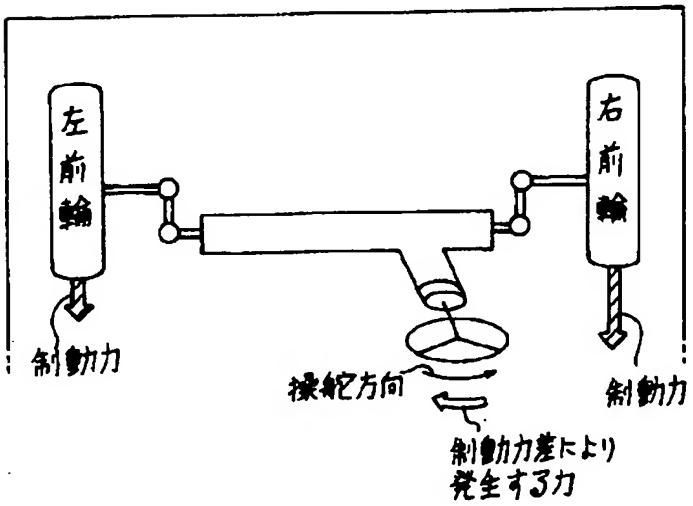

[Translation done.]